ORIENT DISPLAY (North America) Limited

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SPECIFICATION
FOR
LCM MODULE

MODULE NO.: AFA400240C65K-3.0-C03
DOC. REVISION00

Customer Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		
PREPARED BY (QA ENGINEER)		
CHECKED BY		
APPROVED BY		

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	2010-06-05	First issue	

CONTENTS

1. Functions & Features

1.1. Format   : 400x240 Dots
1.2. LCD mode   : Transmissive
1.3. Viewing direction   : 6 O'clock
1.4. Display color   : 262K colors
1.5. Operation temp   : -20~70   ℃
1.6. Storage temp   : -30~80℃
1.7. Power supply voltage (V_{DD})   : 5.0V
1.8. LED power voltage   : 5.0V
1.9. Backlight color   : White(LED)
1.10 LCM Contrast ratio   : 300:1
1.11 LCM Birghtness   : 200 nit(tye)
1.12.RoHS standard

2. MECHANICAL SPECIFICATIONS

2.1. Module size   : 93.0mm(L)*70.0mm(W)*7.0(Max) mm (H)
2.2. Viewing area   : 67.0mm(L)*40.84mm(W)
2.3. Pixel size   : 163.5um(W)*163.5.0um(H)
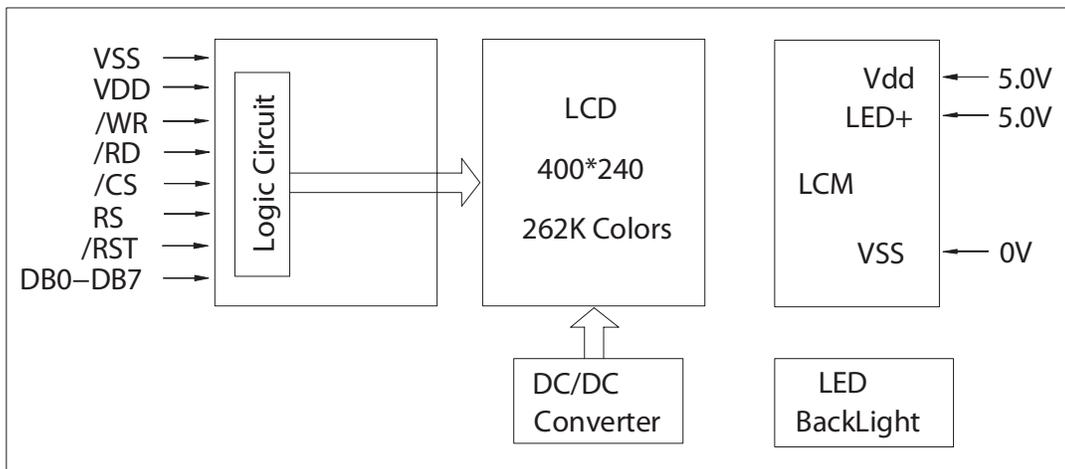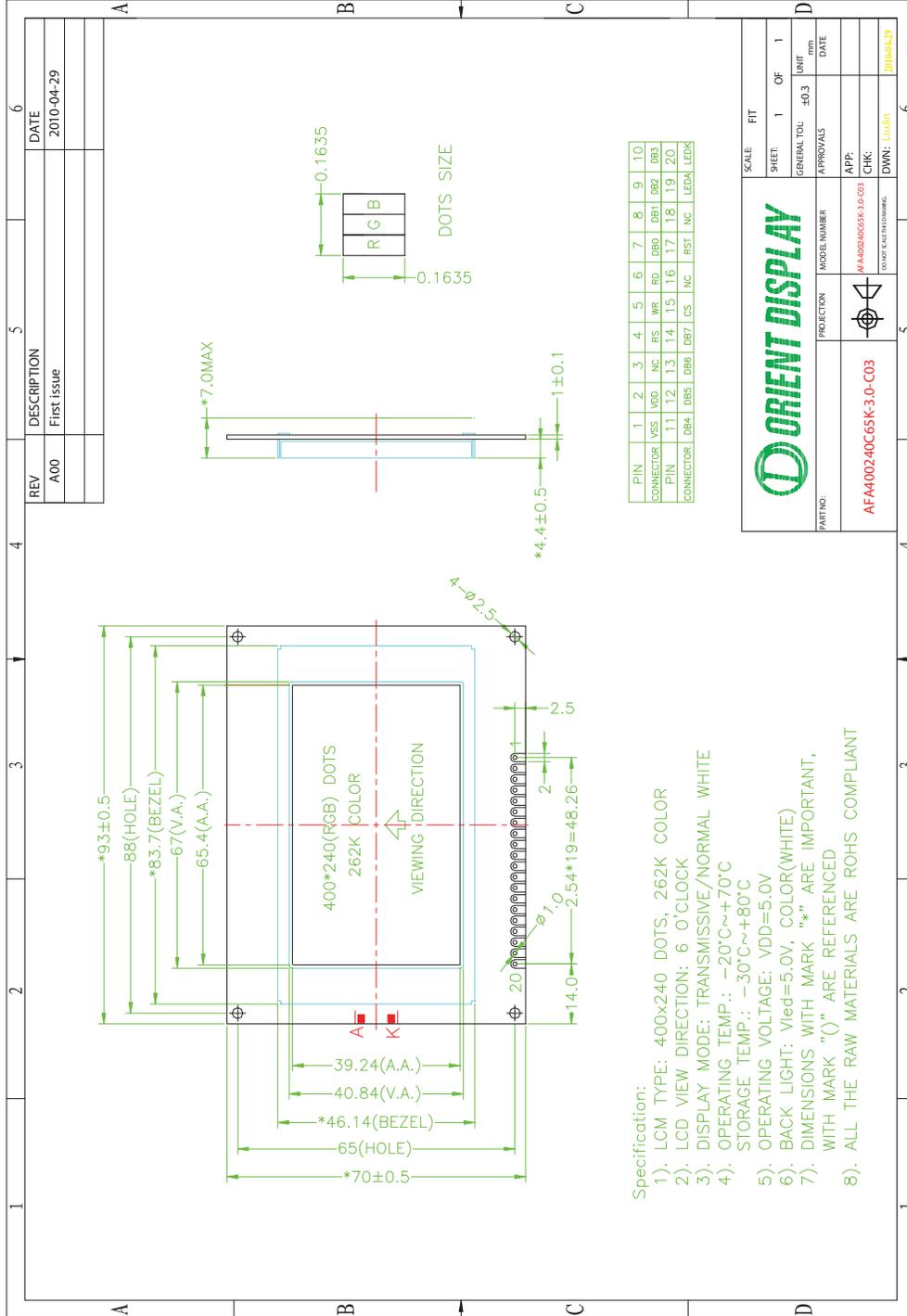2.4. Weight   : Approx.

3. BLOCK DIAGRAM

Figure 1. Block diagram

4. DIMENSIONAL OUTLINE

DOTS SIZE

0.1635

0.1635

R G B

*7.0MAX

1±0.1

*4.4±0.5

PIN	1	2	3	4	5	6	7	8	9	10
CONNECTOR	VSS	VDD	NC	RS	WR	RD	DB0	DB1	DB2	DB3
PIN	11	12	13	14	15	16	17	18	19	20
CONNECTOR	DB4	DB5	DB6	DB7	CS	NC	RST	NC	LEDA	LEDK

4-Ø2.5

2.5

2

2.54*19=48.26

Ø1.0

20

14.0

400*240(RGB) DOTS
262K COLOR

VIEWING DIRECTION

*93±0.5
88(HOLE)
*83.7(BEZEL)
67(V.A.)
65.4(A.A.)

A K

39.24(A.A.)
40.84(V.A.)
*46.14(BEZEL)
65(HOLE)
*70±0.5

Specification:
1). LCM TYPE: 400×240 DOTS, 262K COLOR
2). LCD VIEW DIRECTION: 6 O'CLOCK
3). DISPLAY MODE: TRANSMISSIVE/NORMAL WHITE
4). OPERATING TEMP.: -20°C～+70°C
   STORAGE TEMP.: -30°C～+80°C
5). OPERATING VOLTAGE: VDD=5.0V
6). BACK LIGHT: Vled=5.0V, COLOR(WHITE)
7). DIMENSIONS WITH MARK "*" ARE IMPORTANT,
   WITH MARK "()" ARE REFERENCED
8). ALL THE RAW MATERIALS ARE ROHS COMPLIANT

ORIENT DISPLAY

REV	DESCRIPTION	DATE
A00	First issue	2010-04-29

PART NO: AFA400240C65K-3.0-C03

MODEL NUMBER: AFA400240C65K-3.0-C03

PROJECTION

SCALE: FIT
SHEET: 1 OF 1
GENERAL TOL: ±0.3
UNIT: mm

APPROVALS
APP:
CHK:
DWN: Liu Jin 2010-04-29

DO NOT SCALE THIS DRAWING

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5. PIN DESCRIPTION

No.	Symbol	Function
1	VSS	GND
2	VDD	Logic supply voltage (+5.0V)
3	NC	------
4	RS	Register selection (H:Data register, L:Instruction register)
5	/WR	Write signal
6	/RD	Read signal
7	D0	Data bus line
8	D1	Data bus line
9	D2	Data bus line
10	D3	Data bus line
11	D4	Data bus line
12	D5	Data bus line
13	D6	Data bus line
14	D7	Data bus line
15	/CS	Chip enable signal
16	NC	------
17	/RST	Reset signal (L)
18	NC	------
19	LEDA	Power supply for backlight((+5.0V)
20	LEDK	GND

6. MAXIMUM ABSOUTE LIMIT

Item	Symbol	MIN	MAX	Unit
Supply Voltage for Logic	V_{DD}	-0.3	5.2	V
Input Voltage	V_{in}	-03	$V_{DD}+0.3$	V
Supply Current （Without Backllight）	I_{DD}(Ta = 25°C)		30	mA
Supply Current for Backlight	I_F(Ta = 25°C)	---	60	mA
Reverse Voltage for Backlight	V_R(Ta = 25°C)	---	5.5	V
Operating Temperature	Top	-20	70	℃
Storage Temperature	Tst	-30	80	℃

7. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	V_{DD}-V_{SS}	Ta = 25°C	---	5.0	---	V
Input High Voltage	V_{IH}	Ta = 25°C	08V_{DD}	---	V_{DD}	V
Input Low Voltage	V_{IL}	Ta = 25°C	0	---	02V_{DD}	V
Output High Voltage	V_{OH}	Ta = 25°C	08V_{DD}	---	V_{DD}	V
Output Low Voltage	V_{OL}		0	---	02V_{DD}	V
Supply Current（Without Backllight）	I_{DD}	Ta = 25°C	--	25	30	mA

8. BACKLIGHT CHARACTERISTICS

Ta = 25°C

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	Vled=5.0V	---	5.0	---	V
Forward Current	IR	Vled=5.0V	---	60	---	mA
Luminous Intensity (With LCD dots off)	IV	Vled=5.0V	---	3200	---	Cd/m^2
LED Life time	---	Ta = 25°C Humidity: 70% below Forward Current: 20mA	---	50,000	---	Hr

9. ELECTRO-OPTICAL CHARACTERISTICS

(VDD=5.0V,Vled=5.0V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (CR≥10)	θL	=180°(9 o'clock)	---	65	---	
	θR	=0°(3 o'clock)	---	55	---	degree
	θT	=90°(12 o'clock)	---	50	---	
	θB	=270°(6 o'clock)	---	65	---	
Response time	T on	Normal θ= =0°	---	25	30	ms
	T off		---	30	35	ms
Contrast ratio	Cr		---	350	---	---
Luminance	L1		---	3200		Cd/m2

$$Cr = \frac{\text{Brightness of non-selected segment(B2)}}{\text{Brightness of selected segment(B1)}}$$
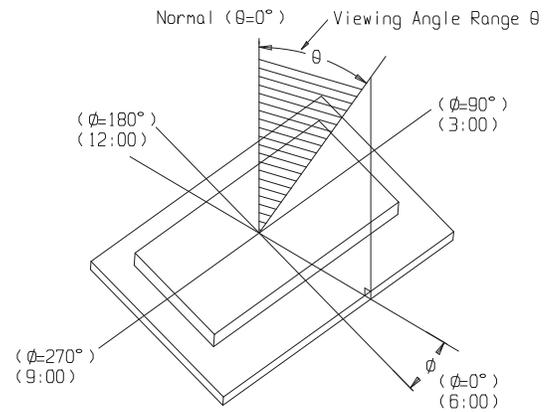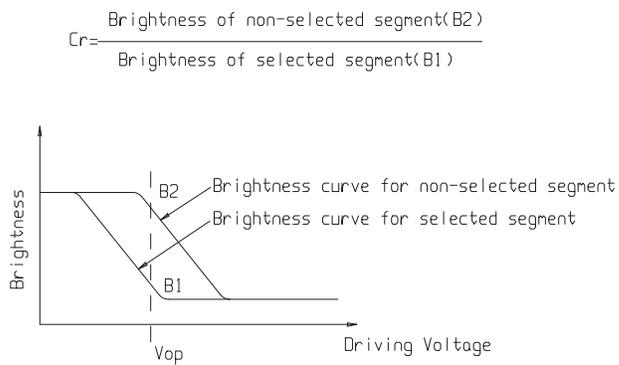
10. TIMING CHARACTERISTICS
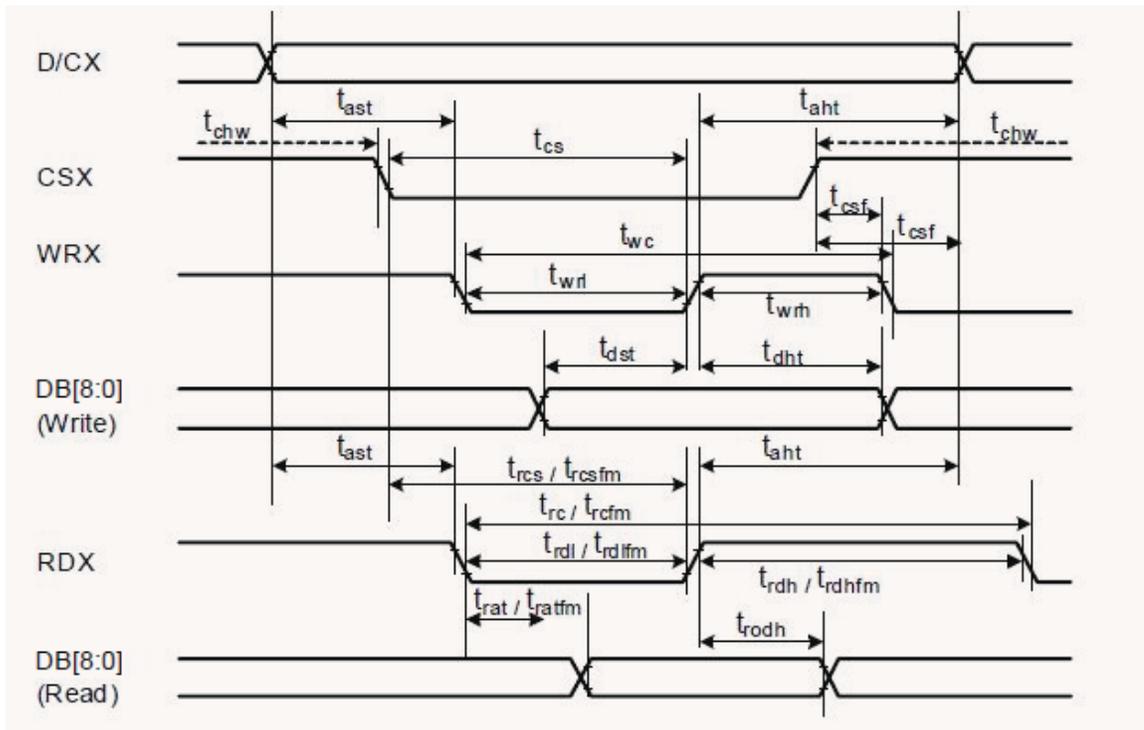
Figure 4. 8080 family Interface Timing

Signal	Symbol	Parameter	min	max	Unit	Description
D/CX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	10	-	ns	
CSX	tchw	CSX "H" Pulse Width	0	-	ns	
	tcs	Chip Select setup time (Write)	20	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	80	-	ns	
	twrh	Write Control pulse H duration	25	-	ns	
	twrl	Write Control pulse L duration	25	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration (ID)	90	-	ns	
	trdl	Read Control pulse L duration (ID)	45	-	ns	
RDX (FM)	trcfm	Read cycle (FM)	450	-	ns	
	trdhfm	Read Control pulse H duration (FM)	90	-	ns	
	trdlfm	Read Control pulse L duration (FM)	355	-	ns	
DB[8:0]	tdst	Data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Data hold time	10	-	ns	
	trat	Read access time (ID)	-	40	ns	
	tratfm	Read access time (FM)	-	340	ns	
	todh	Output disable time	20	-	ns	

11. CONTROL AND DISPLAY INSTRUCTION

Reference : ILI9327 (IC)

Porgram Example

```
// 51 MCU,  65K colors
#include <reg51.h>
#include <absacc.h>
#include <ctype.h>
#include <intrins.h>
#include <setjmp.h>
#include <stdarg.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <math.h>
#define uint unsigned int
#define uchar unsigned char
#define xchar unsigned char code

sbit CSTFT  = P3^0;
sbit RSTFT  = P3^1;
sbit WRTFT  = P3^2;
sbit RDTFT  = P3^3;
sbit RESTFT = P3^4;
//-----------------------------
uint deywc;
```

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```c
uint deywd;
uint deyrd;
//-----------------------------
void delayms(uint ms)
{
  while(ms)
  { ms--;}
}
//-------------------------------------------
void delay(uint ss)
{
  uint mm;
  while(ss-->0)
  for(mm=0;mm<1000;mm++) { }
}
//-------------------------------------------

void wcomd(uchar index)
{
  CSTFT = 0;
  RSTFT = 0;
  P2 =index;
  WRTFT = 0;delayms(deywc);
  WRTFT = 1;
  CSTFT = 1;
}

void wdatac(uchar datc)
{
  CSTFT = 0;
  RSTFT = 1;
  P2 = datc;
  WRTFT = 0;delayms(deywd);
  WRTFT = 1;
  CSTFT = 1;
}

void wdata(uchar xsdat)
{
  CSTFT = 0;
  RSTFT = 1;
  P2 =xsdat;
  WRTFT = 0;delayms(deywd);
  WRTFT = 1;
  CSTFT = 1;
}

unsigned char rdata(void)
{
  uchar ch;
  P2=0xff;
  CSTFT=0;
  WRTFT=1;
  RSTFT=1;
```

```c
  RDTFT=0; delayms(deyrd);
  ch=P2;
  RDTFT=1;
  CSTFT=1;
  return(ch);
}

void initial_tft()
{
 wcomd(0xE9);
   wdatac(0x20);
 wcomd(0x11);   //Exit Sleep
   delayms(100);
 wcomd(0xD1);
  wdatac(0x00);
  wdatac(0x54);
  wdatac(0x12);
 wcomd(0xD0);
  wdatac(0x07);
  wdatac(0x01);
  wdatac(0x0f);
 wcomd(0x36);
        wdatac(0x08);
 wcomd(0xC1);
        wdatac(0x10);
        wdatac(0x10);
        wdatac(0x02);
        wdatac(0x02);
 wcomd(0xC0);   // Set Default Gamma
        wdatac(0x00);
        wdatac(0x35);
        wdatac(0x00);
        wdatac(0x00);
        wdatac(0x01);
        wdatac(0x02);
 wcomd(0xC5);   // Set frame rate
        wdatac(0x02);
 wcomd(0xD2);   // power setting
        wdatac(0x01);
        wdatac(0x12);
 wcomd(0xC8);   // set gamma
        wdatac(0x04);
        wdatac(0x67);
        wdatac(0x35);
        wdatac(0x04);
        wdatac(0x08);
        wdatac(0x06);
        wdatac(0x24);
        wdatac(0x01);
        wdatac(0x37);
        wdatac(0x40);
        wdatac(0x03);
        wdatac(0x10);
        wdatac(0x08);
```

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```c
 wdatac(0x80);
        wdatac(0x00);
 wcomd(0xc9);    // set gamma
        wdatac(0x0d);
        wdatac(0x09);
        wdatac(0x09);
        wdatac(0x09);
        wdatac(0x09);
        wdatac(0x09);
        wdatac(0x09);
        wdatac(0x0b);
        wdatac(0x0b);
        wdatac(0x0d);
        wdatac(0x0d);
        wdatac(0x0e);
        wdatac(0x0e);
        wdatac(0x00);
        wdatac(0x00);
        wdatac(0x00);
        wdatac(0x00);
        wdatac(0x00);
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        wdatac(0x01);
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        wdatac(0x01);
        wdatac(0x01);
```

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wdatac(0x01);
wdatac(0x01);
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wdatac(0x01);
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wdatac(0x01);
wdatac(0x01);
wdatac(0x01);
wdatac(0x01);
wdatac(0x01);
wdatac(0x04);
wdatac(0x0d);
wdatac(0x09);
wdatac(0x09);
wdatac(0x09);
wdatac(0x09);
wdatac(0x09);
wdatac(0x09);
wdatac(0x09);
wdatac(0x0B);
wdatac(0x0B);
wdatac(0x0D);
wdatac(0x0D);
wdatac(0x0E);
wdatac(0x0E);
wdatac(0x0E);
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wdatac(0x01);
wdatac(0x01);
wdatac(0x01);
wdatac(0x01);
wdatac(0x01);
wdatac(0x01);
```

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```
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
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        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x01);
        wdatac(0x04);
        wdatac(0x04);
  wcomd(0xea);    //Enable 3 Gamma
        wdatac(0x80);
 wcomd(0x3a);
   wdatac(0x55);
 wcomd(0x29);
 wcomd(0x2c);
 //wcomd(0x10);  //enter_sleep
 //wcomd(0x11);  //exit_sleep
}
//---------------------------------------------
void waddr(uint sadd,uint eadd)
{
 uint temdat1,temdat2,temdat3,temdat4;
 temdat1=sadd/256;
 temdat2=sadd%256;
 temdat3=eadd/256;
 temdat4=eadd%256;

 CSTFT = 0;
 RSTFT = 1;
 P2 = temdat1;
 WRTFT = 0;
 WRTFT = 1;
 P2 = temdat2;
 WRTFT = 0;
 WRTFT = 1;
 CSTFT = 1;

 CSTFT = 0;
 RSTFT = 1;
 P2 = temdat3;
```

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```
  WRTFT = 0;
  WRTFT = 1;
  P2 = temdat4;
  WRTFT = 0;
  WRTFT = 1;
  CSTFT = 1;
}
//--------------------------------------------
void disp_all(uchar xsdat1,uchar xsdat2)
{
  uint j,k;

  wcomd(0x2a);    //column address set
  waddr(0,399);
  wcomd(0x2b);    //row address set
  waddr(0,299);

  wcomd(0x2c);
  for(k=0;k<400;k++)
  {
          for(j=0;j<240;j++)
          {
     wdata(xsdat1);wdata(xsdat2);
   }
  }
}


//=============================================
////////////////// MAIN ///////////////////////////
//=============================================

void main(void)
{
  RESTFT=0;delay(100);RESTFT=1;delay(10);

  initial_tft();

  deywc=2;
  deywd=2;
  deyrd=2;

  wcomd(0x36);
  wdatac(0x28);
  while(1)
  {
     disp_all(0x00,0x00); delay(200);  //display black
     disp_all(0xff,0xff); delay(200);  //display white
     disp_all(0xf8,0x00); delay(200);  //display red
     disp_all(0x07,0xe0); delay(200);  //display green
     disp_all(0x00,0x1f); delay(200);  //display blue
   ........
  }
}
```

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12.QUALITY SPECIFICATIONS

12.1 Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.
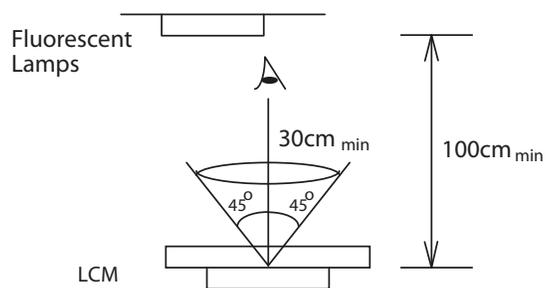
Definition of zone:
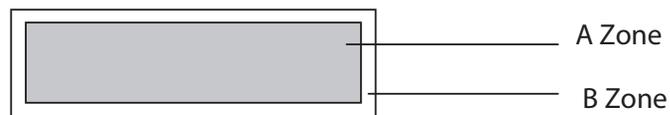
A Zone: Active display area (minimum viewing area).
B Zone: Non-active display area (outside viewing area).

12.2 Specification of quality assurance

AQL inspection standard

Sampling method: MIL-STD-105E, Level II, single sampling

Defect classification (Note: * is not including)

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Classify		Item	Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
		Protruded	12	
	Polarizer	Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

Note on defect classification

No.	Item	Criterion
1	Short or open circuit	Not allow
	LC leakage	
	Flickering	
	No display	
	Wrong viewing direction	
	Wrong Back-light	
2	Contrast defect	Refer to approval sample
	Background color deviation	
3	Point defect, Black spot, dust (including Polarizer) $\varphi = (X+Y)/2$	Unit：mm
4	Line defect, Scratch	Unit: mm
5	Rainbow	Not more than two color changes across the viewing area.

For item 3, Point defect:

Point Size	Acceptable Qty.
$\varphi \leqslant 0.10$	Disregard
$0.10 < \varphi \leqslant 0.20$	3
$0.20 < \varphi \leqslant 0.25$	2
$0.25 < \varphi \leqslant 0.30$	1
$\varphi > 0.30$	0

For item 4, Line defect:

Line		Acceptable Qty.
L	W	
---	$0.015 \geqslant W$	Disregard
$5.0 \geqslant L$	$0.03 \geqslant W$	2
$5.0 \geqslant L$	$0.05 \geqslant W$	
$5.0 \geqslant L$	$0.1 > W$	1
---	$0.05 < W$	Applied as point defect

No	Item	Criterion

6   Chip

Remark:
- X: Length direction
- Y: Short direction
- Z: Thickness direction
- t: Glass thickness
- W: Terminal Width
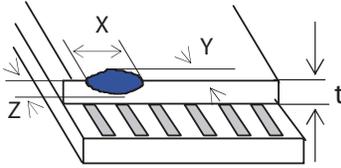
Acceptable criterion

X	Y	Z
≤2	0.5mm	≤t/2
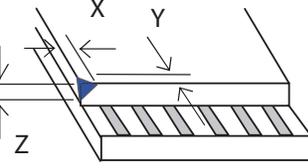
Acceptable criterion

X	Y	Z
≤3	0.5mm	≤t
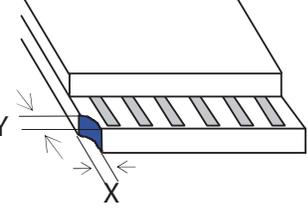
Acceptable criterion

X	Y	Z
≤3	≤2	≤t
	shall not reach to ITO	
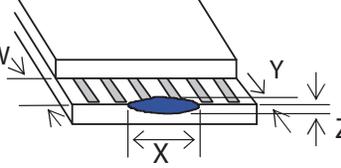
Acceptable criterion

X	Y	Z
Disegard	≤0.2	≤t

Acceptable criterion

X	Y	Z
≤5	≤2	≤t/3

No.	Item	Criterion
7	Segment pattern W = Segment width $\varphi = (X+Y)/2$	(1) Pin hole $\varphi < 0.10mm$ is acceptable. X X Y Y W | Point Size	Acceptable Qty | | $\varphi \leqslant 1/4W$ | Disregard | | $1/4W < \varphi \leqslant 1/2W$ | 1 | | $\varphi > 1/2W$ | 0 | Unit: m m
8	Back-light	(1) The color of backlight should correspond its specification. (2) Not allow flickering
9	Soldering	(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land. Lead Land 50% lead
10	Wire	(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.
11*	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.
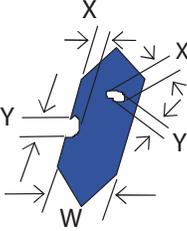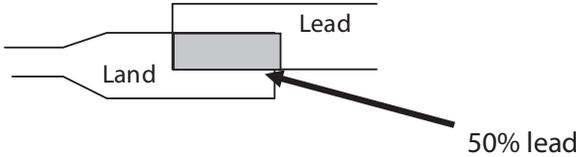
No	Item	Criterion
12	Protruded W: Terminal Width	Acceptable criteria: $Y \leq 0.4$
13	TAB	1. Position $W1 \leq 1/3W$ $H1 \leq 1/3H$ 2 TAB bonding strength test P (=F/TAB bonding width) $\geq$650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.
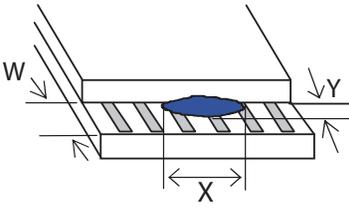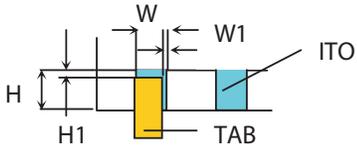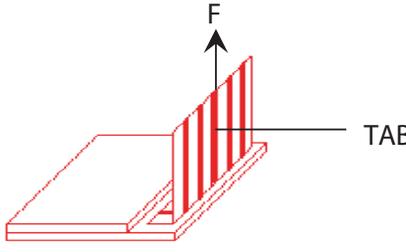
12.3 Reliability of LCM
Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	No abnormalities in functions and appearance
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	
Low temp. Operating	-20°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	-20°C ⇄ 25°C ⇄ 70°C (30 min ⇄ 5 min ⇄ 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance ,etc.
shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage
conditions room temperature (20±8°C), normal humidity (below 45±20% RH), and in the area not
exposed to direct sun light. The life time is not content the life time of the LED (for the life time of
LED which decay only 50%,in the industry the experience value is 50000 hours, but there are not
any experimentation data to support this). .

12.4 Precaution for using LCD/LCM
LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any
alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto
   the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should
   be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or
   other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not
   use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting Orient Display.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or
   twisting. Elastomer contacts are very delicate and missing pixels could result from slight
   dislocation of any of the elements.

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6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.

7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: $280°C \pm 10°C$
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over $40°C$ is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

Orient Display LCDs and modules are not consumer products, but may be incorporated by OD's customers into consumer products or components thereof, Orient Display does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of Orient Display is limted to repair or replacement on the terms set forth below. Orient Display will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnal and/or user. Unless otherwise agreed in writing between Orient Display and the customer, Orient Display will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with Orient Display general LCD inspection standard. (Copies availble on request)

2. No warrenty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.

3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.